Aplysia vaccaria, a New Host for the Pinnotherid Crab *Opisthopus transversus*

BY

ANTHON CRAIG BEONDÉ

Department of Biology
California State College at Long Beach, Long Beach, California 90804

(2 Text figures)

On April 2, 1967, two specimens of *Aplysia vaccaria* Winkler, 1955, were collected at Corona del Mar State Beach, California, for anatomical studies. From each *A. vaccaria* a specimen of the pinnotherid crab *Opisthopus transversus* Rathbun, 1893, was obtained. Both sexes were obtained. The carapace widths were 10.4 mm and 10.5 mm for the male and female respectively. Further collecting at Corona del Mar State Beach, and examination of 15 *A. vaccaria* and 29 *A. californica* Cooper, 1863, did not yield any additional specimens.

The two specimens of *Opisthopus transversus* were originally observed leaving the pallial cavities of *Aplysia vaccaria* while the mollusks were being prepared for dissection. Their significance was not realized at the time and no observations were made on any possible damage they may have done to the pallial cavity or ctenidium.

Pearce (1966) observed extensive ctenidial erosion in *Mytilus edulis* Linnaeus, 1758, associated with the pinnotherid crab *Fabia subquadrata* Dana, 1851. MacGinitie & MacGinitie (1949) and Pearce (1966) both observed that *Fabia* fed upon the food string produced by the ctenidia in *Mytilus* and that while feeding upon this string would occasionally eat sections of the ctenidium. McDermott (1962) had made similar observations with *Pinnotheres ostreum* Say, 1817, where he found that the ctenidial edge in *Anomia* showed swelling and perforation accompanied in some cases with polyp erosion.

Numerous hosts for *Opisthopus transversus* have been recorded, although it is seldom mentioned in the literature and rarely encountered. Table 1 gives the recorded hosts along with the respective references.

What may prove to be of more interest is the great number of hosts with which *Opisthopus transversus* has been associated, but that it also chooses to live with *Aplysia*, an animal that to date has no recorded commensal associations, or predators, except possibly *Anthopleura* (Winkler & Tilton, 1962). It was not until 1962 that Vicente described the first known parasite from *Aplysia*: a trematode metacercaria parasitic upon the nerve ganglia.

In its pelecypod hosts, *Opisthopus transversus* remains

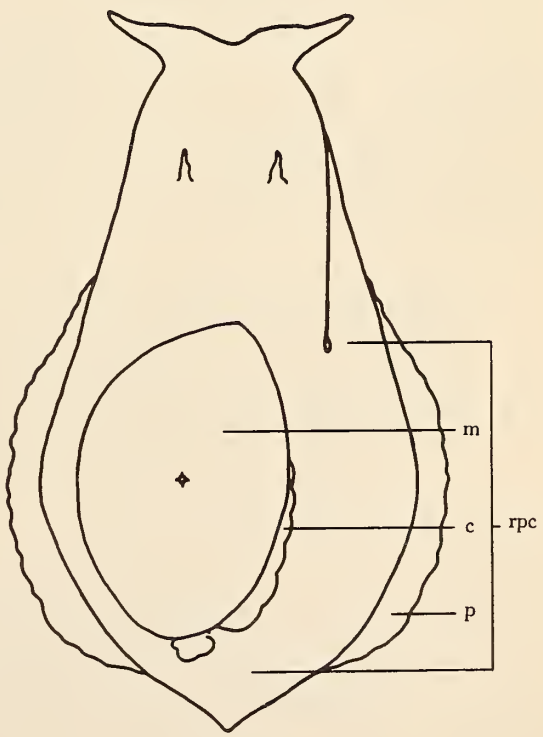

Figure 1

Dorsal View of *Aplysia vaccaria*
C – Ctenidium M – Mantle P – Parapodium
RPC – Right Pallial Cavity

Table 1

Recorded Hosts for the Pinnotherid Crab *Opisthopus transversus* and the Respective Literature References.

Mollusca	
AMPHINEURA	
Amicula stelleri (Middendorff, 1847) (= *Cryptochiton stelleri*)	Ricketts & Calvin, 1939; MacGinitie & MacGinitie, 1949
GASTROPODA	
Megathura crenulata (Sowerby, 1835)	Rathbun, 1893; 1904; 1918; Weymouth, 1910; Schmitt, 1921; Ricketts & Calvin, 1939; MacGinitie & MacGinitie, 1949
Astraea undosa (Wood, 1828)	Schmitt, 1921 [1]
Polinices lewisii (Gould, 1847)	MacGinitie & MacGinitie, 1949
Navanax inermis (Cooper, 1862)	MacGinitie & MacGinitie, 1949
Bulla gouldiana Pilsbry, 1895	Ricketts & Calvin, 1939; MacGinitie & MacGinitie, 1949
Aplysia vaccaria Winkler, 1955	
PELECYPODA	
Mytilus edulis Linnaeus, 1758	Rathbun, 1904; 1918; Schmitt, 1921
Pholas sp.	Rathbun, 1904; 1918; Ricketts & Calvin, 1939
Sanguinolaria nuttallii Conrad, 1837	MacGinitie, 1935; MacGinitie & MacGinitie, 1949
Schizothaerus nuttallii (Conrad, 1837) (= *Tresus nuttallii* Conrad, 1837)	Schmitt, 1921 [1]; Ricketts & Calvin, 1939; MacGinitie & MacGinitie, 1949
Zirfaea sp.	MacGinitie & MacGinitie, 1949
Platyodon sp.	MacGinitie & MacGinitie, 1949
Modiolus sp.	MacGinitie & MacGinitie, 1949
Megapitaria squalida (Sowerby, 1835)	Garth, 1967 [2]
Echinodermata	
HOLOTHUROIDEA	
Stichopus californicus (Stimpson, 1857)	Weymouth, 1910; Rathbun, 1918; Schmitt, 1921, Ricketts & Calvin, 1939; MacGinitie & MacGinitie, 1949

[1] Schmitt (1921) notes that Mr. E. P. Chace of Los Angeles collected specimens with *Astraea undosa* and *Schizothaerus nuttallii.*

[2] Dr. Garth in a personal communication (1967) mentions that only two specimens are in the Allan Hancock collection. One found with *Megapitaria squalida,* was collected at Laguna San Ignacio, Baja California, by Mr. R. L. Eberhart of the California Department of Fish and Game. The other was collected with *Megathura crenulata* at Santa Monica, California.

safe within the confines of, and relies upon the host to collect its food. However, with the gastropod, amphineuran, and holothuroidean hosts it becomes evident that *O. transversus* is forced occasionally to leave the protected confines and forage for food. *Aplysia* does not offer the advantage of being a ctenidial feeder: the ctenidium serves purely a respiratory function.

Figure 1 represents a dorsal view of the pallial cavity of *Aplysia vaccaria* and depicts the large area between the mantle shelf on the left and the overhanging parapodial flap on the right, an area in which the crabs could freely move. *Aplysia vaccaria,* unlike *Aplysia californica,* usually keeps the parapodial flaps closed over the pallial cavity. The parapodia in *A. vaccaria* are thick and muscular while those in *A. californica* are thin and fleshy, which, when the animal is active, hang loosely out into the water, thereby exposing the pallial cavity. Figure 2 depicts what remains of the "left" pallial cavity that would have ancestrally contained the left ctenidium. This is a small cavity found beneath the overhanging mantle with its enclosed shell. There is a small aperture to the pallial cavity at the base of the ctenidium. In a specimen

of *A. vaccaria,* 10 inches long, this cavity is large enough to allow entrance of the index finger with ample room to spare. Since this area is well shut off from the outside and protected by the shell overhead it would be the most likely place to find *Opisthopus transversus.*

Generally pinnotherid crabs display host specificity, but there are recorded instances where more than one host may be utilized, or where more than one host may be involved in the life cycle of a single species. McDermott (1962, in reviewing Christensen, 1958: On the life history and biology of *Pinnotheres pisum*) has reported that *Pinnotheres pisum,* a European species, may utilize two mollusks in completing its life history. He also referred to *P. ostreum,* a species commonly found in the pelecypod *Anomia.* It is evident that *P. ostreum* first invades *Mytilus* in the fall, where it seeks shelter, and matures to the hard stage in winter at which time it is no longer found. Both sexes possibly leave the hosts and seek other mollusks (i. e. *Anomia*) in which the female may grow to maturity. This may partially explain the recorded hosts for *Opisthopus transversus* or it may be simply that *O. transversus* has only recently evolved a commensal relationship and

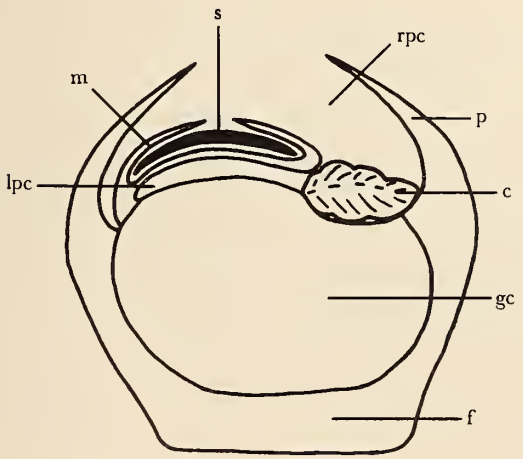

Figure 2

Cross-Sectional View of *Aplysia vaccaria*
C – Ctenidium F – Foot GC – Gut Cavity
LPC – "Left" Pallial Cavity M – Mantle P – Parapodium
RPC – Right Pallial Cavity S – Shell

is presently experimenting with many possible hosts. The choice of a host may therefore be dependent upon three simple factors: 1. the size of the crab itself, 2. the host's ability to supply or bring it within close proximity of a food supply, and 3. the protection afforded by the host animal.

Opisthopus transversus is known to range as far north as Monterey, California (Rathbun, 1904) and as far south as San Felipe, Baja California (Glassell, 1935). Nininger (1918) reported having dredged specimens from a depth as great as 40 metres off Laguna Beach, California. *Aplysia vaccaria* ranges from Morro Bay, California, to Bahía de Los Angeles, Baja California (Lance, 1967), totally within the known range of *O. transversus.*

ACKNOWLEDGMENT

The writer is indebted to Mr. Roby Ward Renshaw, California State College at Long Beach, for his invaluable assistance in preparing and proof reading this paper.

Addendum at time of proof-reading:

The following additions to Table 1, due to the original oversight of

Hopkins, Thomas S. & Thomas B. Scanland

1964. Host relations of a pinnotherid crab *Opisthopus transversus* Rathbun. Bull. So. Calif- Acad. Sci. 63: 175 - 180

should be made:

Opisthopus transversus was found commensally with 4 known hosts: *Megathura crenulata, Astraea undosa, Bulla gouldiana,* and *Schizothaerus nuttallii* [= *Tresus nuttallii*] – and 6 new hosts: the polychacte *Chaetopterus variopedatus* (Renier, 1804), the mollusks *Zirfaea pilsbryi* Lowe, 1931, *Hinnites multirugosus* (Gale, 1928), *Trachycardium robustum* and the holothurians *Parastichopus parvimensis* (Clark, 1913), and *Molpadia arenicola* (Stimpson, 1857).

LITERATURE CITED

Glassell, Steve

1935. New or little known crabs from the Pacific coasts of northern Mexico. San Diego Soc. Nat. Hist. Trans. 8 (14) : 91 - 106

Lance, James Robert

1967. Northern and southern range extensions of *Aplysia vaccaria* (Gastropoda : Opisthobranchia). The Veliger 9 (4) : 412 (1 April 1967)

MacGinitie, George Eber

1935. Ecological aspects of a California marine estuary. Amer. Midl. Natur., 16 (5) : 629 - 765

MacGinitie, George Eber & Nettie MacGinitie

1949. Natural history of marine animals. 473 pp.; illus. McGraw-Hill, New York.

McDermott, John Joseph

1962. Incidence and host parasite relations of pinnotherid crabs. Proc. first Natl. Coastal Shall. Water Res. Conf. pp. 162 - 164

Nininger, Harvey Harlow

1918. Crabs taken at Laguna Beach in the summer of 1916. Journ. Entomol. Zool., Pomona College **10:** 36

Pearce, Jack

1966. The biology of the mussel crab, *Fabia subquadrata,* from the waters of the San Juan Archipelago, Washington. Pacific Sci. **20** (1): 3 - 35

Rathbun, Mary

1893. Descriptions of new genera and species of crabs from the west coast of North America and the Sandwich Islands. Proc. U. S. Nat. Mus. **16:** 252

1904. Decapod Crustacea of the northwest coast of North America. Harriman Alaskan Exped. **10:** 188

1918. Grapsoid crabs of America. U. S. Nat. Mus. Bull. **97:** 461

Ricketts, Edward F. & Jack Calvin

1939. Between Pacific tides. 3rd ed.; Stanford Univ. Press, 516 pp.

Schmitt, Waldo LaSalle

1921. The marine decapod Crustacea of California, with special reference to the decapod Crustacea collected by the United States Bureau of Fisheries steamer "*Albatross*" in connection with the biological survey of San Francisco Bay during the years 1912 - 1913. Univ. Calif. Publ. Zool. 23: 1 - 470; plts. 1 - 50; 165 text figs.

Vicente, N.

1962. Premières observations sur un trematode parasite dans le système nerveux d' *Aplysia fasciata.* Recl. Trav. Stat. mar., Endoume, **41:** 303 - 305

Weymouth, Frank W.

1910. Synopsis of the true crabs (Brachyura) of Monterey Bay, California. Stanford Univ. Publ., Univ. Ser. **4:** 61

Winkler, Lindsay Robert & Bernard E. Tilton

1962. Predation on the California sea hare, *Aplysia californica,* by the solitary great green sea anemone *Anthopleura xanthogrammica,* and the effect of sea hare toxin and acetylcholine on anemone muscle. Pacif. Sci. 16 (3): 286 - 290